

## REMARKS

The claims are 1-14.

Claims 1-14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Gaku et al. (U.S. 5,082,402).

This rejection is respectfully traversed.

Gaku discloses a method of drilling a through-hole in a printed circuit board panel using a water-soluble lubricant sheet. The water-soluble lubricant sheet has a thickness of 0.05-3 mm and comprises a mixture of 20 to 90% by weight of a polyethylene glycol having an average molecular weight of not less than 10,000 and 10-80% by weight of a water-soluble lubricant. The water-soluble lubricant, i.e. all of the lubricants, have a weight average molecular weight of 600-9,000.

The object of Gaku is to prevent heat-generation of a drill bit, to be free from sticking and to give good quality through-holes with good productivity (see col. 1, lines 53 et seq.).

As described in paragraph [0004] of the present specification, the above method has the following defects:

a) a metal foil composite sheet composed of the lubricant sheet and a metal foil warps largely in some cases;

b) when a sheet is integrated with a metal foil, for maintaining bonding properties, it is required to bond the sheet to the metal foil at a temperature where the sheet is sufficiently softened;

c) as a result of above reasons a) and b), the warpage of the resultant composite sheet tends to increase by the influence of thermal shrinkage, which causes a problem with productivity or workability.

d) there is a tendency that location accuracy of a hole decreases with decreasing the diameter of a drill bit to be used.

The present invention intends and succeeds in solving the above problems which were not solved by the cited Gaku reference.

The present invention, as recited in claim 1, contains the following mixture:

(a) polyether ester (I), a solid water-soluble lubricant (II) and polyethylene glycol (III), or  
(b) polyether ester (I), a solid water-soluble lubricant (II) and a liquid water-soluble lubricant (IV).

Gaku discloses the use of a water-soluble lubricant with a polyethylene glycol having an average molecular weight of not less than 10,000.

The water-soluble lubricant can include a polyethylene glycol, a polyoxyethylene monoether, a polyoxyethylene sorbitan monoester etc. and all of the water-soluble lubricant has an average molecular weight of 600 to 9000 (see claim 2).

However, Gaku does not disclose or suggest the use of a solid water-soluble lubricant (II) and polyethylene glycol (III) as an essential component, or the use of a solid water-soluble lubricant (II) and a liquid water-soluble lubricant (IV) as an essential component.

The difference in components in a lubricant sheet make it possible to achieve the object of the present invention. That is, the present invention provides a lubricant sheet comprising an organic substance layer and metal foil, and the lubricant sheet comprising an organic substance layer and metal foil, and the lubricant sheet is almost free from warpage, which problem is not solved by Gaku. The effects of the present invention are shown in Examples 1-6 in terms of warpage of a lubricant sheet.

The present invention in claim 10 recites the following water-soluble polymer layer being formed on one surface of a metal foil:

(a) the water-soluble polymer layer is formed of a mixture of a water-soluble polymer and an organic filler (V);

(b) the surface of a metal foil which is to be bonded to the polymer layer has a surface roughness of from 5 to 15  $\mu\text{m}$ , or

(c) the metal foil is an aluminum foil having an aluminum purity of at least 99.5%.

Gaku does not disclose or suggest the organic filler, the surface roughness of the metal foil and the aluminum purity of the aluminum foil.

The organic filler provides a lubricant sheet which is almost free from the occurrence of warpage as shown in Table 3 (see Example 7 and Comparative Example 3). Gaku does not disclose or suggest the effect of the organic filler.

Gaku also does not disclose or suggest the surface roughness and the aluminum purity when an aluminum foil is used as a metal foil.

The metal foil having a surface roughness of 5 to 15  $\mu\text{m}$  provides an improved adhesion between a metal foil and a sheet as shown at Table 4 (see Examples 10-12 and Comparative Examples 4-6). Gaku does not disclose or suggest the above effect.

The aluminum foil having an aluminum purity of at least 99.5% provides an improved effect of alleviating impact and an improved form of a hole and location accuracy of a hole as shown at Table 5 (see Examples 13-15 and Comparative Examples 7 and 8). Gaku does not disclose or suggest the above effect.

In sum, the objects, components and effects disclosed by Gaku are completely different from and unsuggestive of those of the present invention.


For the foregoing reasons, it is apparent that the rejection on Gaku is untenable and should be withdrawn.

No further issues remaining, allowance of this application is respectfully requested.

If the Examiner has any comments or proposals for expediting prosecution, please contact undersigned at the telephone number below.

Respectfully submitted,

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